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Regarding H.R. 3552 and recent hurricane impacts to the Atlantic and Gulf Coasts

Success of the Coastal Barrier Resources Act The Coastal Barrier Resources Act (CBRA) eliminates federal subsidies for flood insurance, transportation, utilities, and erosion control to support any new development on those areas of barrier islands that are designated as "undeveloped." These areas are designated as "undeveloped" if they have less than one building per five acres or lack complete infrastructure systems. While the law does not explicitly restrict development of these areas, it is intended to shift the financial burden of building or re-building in high-risk areas away from the federal government.

While CBRA may not have halted development in vulnerable coastal areas, it has certainly been successful at reducing the financial burden to federal taxpayers caused by that development. CBRA appropriations should be extended for this reason alone. The environmental benefits of ecosystems protection are convenient, but important, added value. Certainly, updating all System maps and placing them in digital form will be a necessary addition to CBRA management.

Finally, while it is important to identify additional, eligible barriers to add to the Coastal Barrier Resources System, I would like to argue for a larger program. I believe that Congress should consider extending the CBRA restrictions on federal subsidies and limitations on disaster aid to developed, as well as undeveloped, coastal barriers (and other shorelines). Continued federal disaster aid for rebuilding vulnerable coastal areas has cost taxpayers tens of billions of dollars in the last two years. In the discussion below I outline a plan to better protect taxpayers and this valuable and fragile coastline for future generations.

Impact of Hurricane Katrina: I have examined the coastal impact and property damage from Hurricane Katrina through two aerial surveys. What I saw was stunning, although not unforeseeable. The scene in Waveland, Mississippi, today is eerily like the scene following Hurricane Camille in 1969. The same line of storm surge debris is present and again, white concrete pads are all that remain of the coastal homes. The inland extent of active storm surge processes matches, and possibly surpasses that of Hurricane Camille. Initial estimates indicate storm surge levels of 9 m plus. In a zone stretching from The Mississippi line to western Dauphin Island, Alabama, most shoreline property in the immediate coastal zone was obliterated. In many areas the active storm surge and wave impact extended .5 km inland leaving a large, mappable debris line snaking its way across southern Mississippi. The Chandeleur Islands were spread across the Gulf like peanut butter on bread, although the more robust and better-vegetated Mississippi Gulf Islands fared much better. Katrina was a major event, but those of us in the coastal community know that it has happened before, and will happen again.

Figure 1: Waveland, Mississippi after Hurricane Katrina.

Dauphin Island, Alabama: Dauphin Island, in the adjacent state of Alabama, has a more spectacular record of recurring destruction than the Mississippi Coast. This 15-mile long island consists of a low, westward extending spit. Katrina destroyed 150 homes on western Dauphin Island even though it was on the periphery of the hurricane, not in the storms more dangerous center. The western end of Dauphin Island is typical of many of the low lying barrier islands that line the southeast U.S, coast from New York around to Mexico. The island is migrating landward in response to rising sea level and storm impact. During Katrina, Dauphin Island slid out from underneath many oceanfront homes as it migrated northward during the storm. At the same time, overwash added width to the back of island leaving boat houses stranded on land.

Dauphin Island has been repeatedly slammed by storms, and it has been repeatedly rebuilt: Hurricane Frederic (1979), Hurricanes Danny (1997), Georges (1998) and Ivan 2004. The clean up from Ivan hadn't even been completed when Katrina struck. In the 1940's and 1950's, wide inlets were cut across the island by storms. After Hurricane Frederic, brief consideration was given to not rebuilding the destroyed bridge to the island and thereby discouraging intense development. The moment of rationality passed and a new $38 million bridge was constructed. Dauphin Island is a classic example of a shoreline that should never have been developed, and later, should never have been rebuilt. And it is a prime example of a shoreline that should be receiving no federal funds for rebuilding.

Figure 2: Dauphin Island, Alabama after Hurricane Katrina.

Time for the Federal Government to Abandon the Coast: Irresponsible development of vulnerable coastal areas is becoming a burden on an already overburdened federal budget, as well as an environmental disaster. Add Katrina to the battering that Florida has absorbed in the last two years, and we have a sobering glimpse into the future of US shorelines during a period of enhanced storm activity. Many researchers believe that increased sea surface temperatures will provide an onslaught of ever more powerful storms of greater duration. In addition, we have been experiencing an upturn in the number of storms due to natural storm-frequency cycles. The future does not look promising for coastal property.

I believe that it is time to cut our ties with the most vulnerable of our nation's coastal areas. I will restrict my analysis to immediate coastal zone. The issue of what to do with cities like New Orleans is outside the scope of this commentary. The Federal Emergency Management Agency (FEMA), the United States Geological Survey (USGS), the United States Army Corps of Engineers, and numerous researchers — myself included — have spent many years mapping and delineating those coastal areas that are particularly vulnerable to hurricane impact. The highly vulnerable shorelines include places like North Topsail Island in our home state of North Carolina, Santa Rosa Island, FL, and the west end of Dauphin Island in Alabama. Waveland,

Mississippi has been destroyed twice in 35 years. These are all stretches of shoreline that are so unquestionably vulnerable to storm impact that they should never again receive federal tax dollars to rebuild buildings or infrastructure. While there are many coastal areas destroyed by Hurricane Katrina that should not be rebuilt. There are several obstacles to preventing that rebuilding: 1) *We are a compassionate nation. We sympathize with and grieve for the victims of the storm as we watch the endless coverage of Katrina's destruction. Those of us who suggest that we may want to reconsider allowing everyone to rebuild are chastised as being insensitive or callous.* We must separate our justified compassion for those who have suffered from a national debate of what happens after the storm. Suggesting that the Federal government abandon the subsidizing of coastal infrastructure is not advocating the removal of immediate storm aid (rescue, food, shelter) to those impacted by a storm. I am simply advocating the wise use of federal infrastructure rebuilding dollars, and preservation of our coastal environment. 2) *We are a proud nation. We have a tradition of standing tall in the face of adversity and replanting the flag. Americans often admire the resilient attitude of coastal residents, "I will not be chased from my community. We will rebuild. But we need help," one resident of Grand Isle, Louisiana, told a reporter. Those of us who suggest abandoning high-risk communities are viewed as defeatist or anti-development.* At some point we have to recognize this stoicism for what it is— insanity or hubris. Waveland, MS, has been leveled twice in 35 years. Is rebuilding that community admirable or folly? Dauphin Island, AL, is nothing but a sandbar. Is rebuilding on Dauphin Island a model of American resilience or irresponsible risk taking? The coastal science community knows that in both cases, it is the latter. 3) *The argument is frequently put forward that coastal development and infrastructure is an economic powerhouse driving employment and tax revenues critical to many communities and many states. Therefore, federal aid for rebuilding and federally managed flood insurance is critical to maintaining that economic engine.* This is a false argument. If the economics are so overwhelmingly positive, than federal back up should not be necessary. We, as a nation, cannot continue to subsidize those who want to live and work on the immediate coast. This is not simply an environmental issue. This is an issue of fiscal conservatism and fairness. If coastal development is such an economic powerhouse that it is essential to the viability of a locality or a state, then let's let the free market decide. No more federal money for rebuilding infrastructure. No more federally subsidized flood insurance. Let's let each subdivision, or town, or county, or state develop their own plan for self-insurance of those high-risk coastal areas. If that insurance is too costly, then building there is impractical. The federal government should not be involved in subsidizing the risk. People who live in North Dakota should not be providing coastal welfare for developers in Florida. 4) *We have a strong personal property ethic in this country. Coastal property owners have been very successful at asserting property rights in order to circumvent state laws restricting coastal development (e.g. Luca vs. South Carolina Coastal Council).* I would like to see that matched by a strong personal responsibility ethic. If you want to live in the high risk areas, if your community thinks that the economic benefits are too great to abandon the redevelopment of a storm-impacted oceanfront, great. From now on, you pay. You pay for the infrastructure, the buildings, and the beach replenishment. I would rather see the immediate oceanfront abandoned as a storm buffer and public use area, but for those who insist on remaining, I would like to see them accept responsibility for their decisions. Don't look repeatedly for a Federal bailout.

Proposed mechanism for a federal retreat: It is difficult, but not impossible, in the middle of a disaster like Hurricane Katrina to decide which communities should be abandoned. The wound is still too tender, and the rush to rebuild still too chaotic. We need to develop a national policy for the future— one that can be implemented with each storm. We need to objectively determine those coastal areas from which we will retreat (pull federal support). We have the knowledge and the data to identify these particularly vulnerable areas. I suggest the formation of a commission similar to the Base Realignment and Closing Commission (BRAC). This Shoreline Retreat Advisory Commission (ShRAC) would be composed of objective scientists and coastal managers. Like the BRAC there should be no politicians or individuals whose job involves guarding coastal constituencies. The ShRAC would meet every five years to identify vulnerable shorelines that will be removed from all future federal assistance. Some of the federal money saved by switching the rebuilding responsibility to local effort could be used to create public access areas along abandoned oceanfront, rebuilding sand dunes, aiding communities that choose a planned retreat. In the end, we may be forced into this solution if the coastal impact of more storms like Katrina balloons our federal deficit to the extent that harm is done to the national economy.

In essence, Congress would be extending CBRAs restrictions on federal subsidy of new development, flood insurance, and infrastructure rebuilding to shorelines that are already developed, but identifiably vulnerable. Perhaps, these communities could be given a "one more strike and your out" warning. The federal government will support disaster assistance after the next storm, but then the community will be on its own. This will soften the blow and allow localities to plan how they will respond to the federal retreat.

Some additional issues regarding hurricane impact, the coastal zone, and federal responsibility.

Is beach replenishment the solution? The flurry of hurricane activity over the last two years has refocused the public's attention on the federal government's role in financing coastal development. Nowhere is this more evident than with the debate over beach renourishment. Beach renourishment is the artificial addition of sand to an eroded beach to widen it. Many coastal politicians, coastal managers, and engineers have called on the Federal government to recommit to rebuilding the nation's beaches along with the coastal infrastructure after storms. Advocates argue that beach renourishment is an important mechanism for protecting coastal property, and that it is critical to coastal economies trying to maintain a usable beach for residents and tourists. Recently, supporters of beach renourishment have taken to calling it "restoration" in order to give it a more environmentally friendly ring. While it may be true that renourishment is economically important to coastal communities, I believe that the federal government should play no part in financing these projects.

First, a brief geology lesson. Almost all of the shorelines in the US are in a state of long-term retreat in response to rising sea levels. This is natural. Shorelines move both seaward and landward through time in response to changes in climate and ocean volume. A natural, undeveloped shoreline may move landward as sea level rises (shoreline retreat), but it never loses its beach. The beach simply slides landward with the retreating shoreline. So coastal "erosion" is a natural process that does not cause the beach to disappear. What does cause the beach to disappear is the placement of a seawall or a row of buildings in the way of this retreating shoreline. So if a beach is disappearing due to erosion, it is because most developed beaches can no longer respond naturally to shoreline retreat. Mother nature isn't destroying the beach, development is.

Beach renourishment is an ultimately futile effort to hold the shoreline in place against the tide of rising sea level and increasing storms. And it is expensive. More than $600 million has been spent pumping sand onto Florida's beaches alone— most of that was federal money.

Let's address the arguments for beach renourishment. While it is true that large nourishment projects may provide some protection during small storms, not even a billion-dollar beach would have protected Mississippi lives and property against the 30 ft maximum storm surge of Katrina. In the long run, beach renourishment probably does more harm than good. The reconstructed, wide beach gives the appearance of a shoreline that is stable and safe, encouraging shoreline development. This deception can actually place more property and lives at risk. Renourishment advocates are selling the projects as storm defense in order to make them more palatable. But the skyrocketing cost of the sand and limited effectiveness in large storms makes renourishment a bad deal for federal taxpayers. Besides, it is maddening to imagine that some folks believe that the primary role of a beach is to protect buildings

Some have argued that the federal government should play a major role in financing beach renourishment because numerous federal navigation projects (stabilized inlets) have negatively impacted adjacent beaches. While this may be true in some cases, the issue is a complex one. Isn't the maintenance of navigable inlets important economically as well (think, cruise ships)? Imagine the hue and cry if the federal government decided to abandon or even close inlets like Port Canaveral, Florida. In this case the federal government is becoming a convenient scapegoat for providing a service that most Floridians would believe is beneficial. You can't have it both ways.

And what about the economic benefits of renourishment? There is little question that robust coastal tourism requires a beach for visitors. And certainly, the Miami Beach replenishment project was worth its weight in gold for those who benefit from that tourist economy. But if the economics of beach replenishment are so good, why are federal dollars required? These projects should be paid for locally. Renourishment advocates often argue that the projects power such a strong economic engine that taxpayers get their money back through increased tax revenues. So let's see how this works from the perspective of a coastal community: taxpayers give us lots of money to maintain a beach in front of our buildings, therefore we all make lots of money on tourism, and because we're all getting rich, we pay more taxes, so taxpayers get their money

back, and we have a booming economy. Sounds fair, right? Except, why only subsidize the coastal economy? I live in the mountains of North Carolina. Give us $600 million to pump into our tourist economy and maybe we can create an economic powerhouse. Heck, we could build some beaches here. In the end, the federal money is subsidizing one economy over another. And the coastal economy is a bad choice for subsidy. Witness the Florida hurricanes of the last two years, Katrina, Rita, and the next.

The bottom line is that beach nourishment cannot be the overall solution to the erosion problem along thousands of miles of shoreline. It costs too much, it does not protect property and lives as sold, and it is actually increasing the amount of property and the number of people in danger. Most importantly, federal disaster relief funds should not be used to rebuild beaches.

What about Restoring Louisiana's Wetlands and Barrier Islands: Now dominating the public discussion following Hurricane Katrina is the need for implementation of a massive plan to restore Louisiana's coastal wetlands and the delta's barrier islands. This effort has been strongly advocated by Louisiana scientists, engineers, land managers, and environmentalists alike. It is well documented that Louisiana is suffering the highest rate of land loss in the US. The wetlands in the Mississippi River delta region have been disappearing due to a variety of causes, most of which are human-induced. The price tag associated with the project is often placed at $14-15 billion.

As a coastal scientist, I value the benefits of wetlands as unique habitats. But I have the following concerns about the advocacy of the Louisiana coastal restoration:

1) During interviews with national media, many individuals have insinuated that the wetland restoration (had it been in place), would have reduced the impact of Katrina on New Orleans or coastal Louisiana. This is highly unlikely. Storm surge waters approached the coast from the east, pushed into Lake Pontchartrain by the counterclockwise flow of Katrina’s winds, and it is my opinion that any additional wetland would have done little to mitigate storm impact.

2) It has been suggested that rebuilding and maintaining the offshore barrier islands would provide protection for the wetlands and property in the delta region. Again, I believe that this hypothesis is untested and unlikely to be true. Hurricane Katrina’s storm surge simply inundated all of the Mississippi barriers islands in Gulf Islands National Seashore on its way to devastating the inland shorelines of Mississippi. And the Mississippi barrier islands are far more robust and well vegetated than the Chandeleurs or Isle Deniers, Louisiana’s barrier islands. These were no more than a tiny speed bump to the forces of Katrina.

3) The restoration plan, does little to address the root causes of wetland loss: sediment deficit in the Mississippi River and sea level rise. Rather, it is a massive engineering project designed to fix problems caused by engineering. I find it ironic that some of the same people calling for higher levees are calling for wetlands restoration. The fact of the matter is that maintaining these wetlands in a regime of worldwide rising sea level (at accelerating rates) is probably untenable. We would be creating our own little Holland with need for engineering and maintenance expenditures escalating far into the future.

4) I am a strong advocate of wetland protection and restoration. If the federal Government is going to spend $14-15 billion on wetland restoration, let's put all US wetlands on the table. Many states in addition to Louisiana are rapidly losing coastal wetlands. Isolated wetlands have been removed from federal protection nationwide. Funds of that magnitude should be spent where the highest rate of success is likely. I'm not sure that would be the Louisiana delta region.

I believe that there are many concerned and honest advocates for the project to restore coastal Louisiana. I simply argue that the effort shouldn't be mislabeled as storm protection and we shouldn't rush into the expenditure. And wetland restoration shouldn't be used as an argument for maintaining viable communities in America's most vulnerable coastal region. That would be irresponsible.

Gulf Islands National Seashore Gulf Islands National Seashore (GINS), on the Florida panhandle, is facing a shoreline management crisis. In many ways the problems being faced, and the decisions being made, are emblematic of the issues facing coastal communities all over the US. Yet, because GINS is a national park, management requires the special care due public trust lands.

The park protects important barrier island ecosystems and historical resources stretching from Florida to Mississippi. Much of GINS is undeveloped. Some portions, like the Fort Pickens Unit in western Florida, are developed for visitor access and recreation.

Figure 3: Debris from the Ft. Pickens Road, Gulf Islands National Seashore.

The dual role the Park plays in meeting visitor access and protecting the natural environment is being tested by recent hurricanes. Here is the problem; the Fort Pickens Road keeps washing out. Last year, the road was destroyed by Hurricane Ivan. The Park decided to rebuild this asphalt roadway using a program that funds emergency reconstruction of federal highways. Four days before reopening the new road, Tropical Storm Arlene damaged major sections. Shortly thereafter, Hurricane Dennis finished it off. It is likely that there would have been more damage from Katrina had there been any road left to rip up.

The road has been impacted before. Hurricane Opal in 1995 destroyed the Fort Pickens Road, and even Hurricanes Georges and Isidore left their mark. The response of GINS to this litany of costly destruction is always the same. Rebuild. It seems likely that this will be the case again. The Park, in consultation with the Florida Department of Transportation, is poised to once again throw millions of dollars at a road located a couple of feet above sea level on a very narrow barrier island.

In my opinion, Gulf Islands National Seashore is home to the most vulnerable road in America. The roadbed doesn't exist any more. The barrier island has been breached, and GINS is trying to build and maintain a road across several sections of island that are now essentially tidal inlets.

Old road material lies buried in the beach sand. There are piles of asphalt from the damaged roads. It is ugly. And, what are the costs? There are several. Most obvious is the fact that rebuilding the Fort Pickens Road has become a grand waste of federal taxpayers' money. The Park delayed rebuilding this summer because it would be too embarrassing to have it destroyed twice in one hurricane season. Also, there are environmental costs. At the moment, GINS is treating the barrier island that it is charged with protecting as nothing more than a roadbed allowing visitor access. It is hard to imagine the impact that repeated construction, grading, and then asphalt debris is having on the natural beach and the marine ecosystem bordering the Park.

Finally, what is most upsetting to me is that all of this is happening within the confines of the National Park Service— an agency, and a mission, for which I have tremendous respect and appreciation. Parks should be leading the way in providing an environmentally friendly response to hurricane damage. Parks should be providing the model for creative thinking in response to storm vulnerability. The decision-makers at Gulf Islands National Seashore have lost sight of reality. You cannot maintain that road! It will be torn up again!

There are other ways to get visitors to Fort Pickens. There are alternatives to repeatedly replacing the asphalt (at taxpayer expense). I urge the managers at GINS to take another look at their plans to seek a longer-term solution. There is growing local support for abandonment of the Fort Pickens Road.

If not, we can all place bets on which named storm will wash away the next multimillion-dollar road. The safe bet is that this storm will occur very soon.

Coasts are becoming one, continuous engineering project: As my aerial survey continued past the Katrina impact zone into the Florida panhandle, I made a startling observation. Every stretch of shoreline I saw had either been recently bull-dozed, bermed, replenished, covered with debris, or somehow manipulated by humans. Even Gulf Islands National Seashore's road to Fort Pickens was reduced to a pile of asphalt resting on the edge of a breach that was reopened during Tropical storm Arlene. The National Park Service seems poised to rebuild this road on a "sandbar". The beaches along the Gulf shoreline have been reduced to a strip of engineered storm defense. There is little natural about them. Theoretically, those beaches belong to all of us. They are a part of our nation's natural heritage. The sight made me angry, but even more so, I was deeply saddened. The storm battering that our shorelines have absorbed over the last two years is a wake up call. Congress needs to create a bold new vision of how we can protect these vulnerable ecosystems, property, lives, and taxpayers dollars from future storms. The only way to meet all of these goals is through a strategic federal retreat from our nation's most vulnerable shorelines.

Abbreviated Curriculum Vitae

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Education

- Ph.D. in Geology, Duke University, 1995 Dissertation: The impact of sea-level rise on the coastal wetlands in Albemarle, Pamlico, and Currituck Sounds, North Carolina: A study of sedimentology, stratigraphy, and wetland dynamics.
- M.S. in Quaternary Studies/Geology, University of Maine, 1990 Thesis: The Late Quaternary Geomorphic Evolution, Seismic Stratigraphy, and Geoarchaeology of Johns Bay and Pemaquid Beach, Maine.
- B.S. in Geology (*Phi Beta Kappa*), College of William & Mary, 1987

Licensed Professional Geologist: State of North Carolina Lic. # 1980

Employment Experience

- Associate Professor of Geology, Western Carolina University: 2001-present
- Director, Helen Patton Environmental Research Center: 2002-present
- Assistant Professor of Geology, Western Carolina University: 1997-2001
- Assistant Professor of Geology, University of Vermont: 1995-1997
- Research Associate, Program for the Study of Developed Shorelines, Duke University: 1989-1995
- North Carolina Geological Survey Summer Research Fellow: 1993
- Archaeological Field Crew, University of Maine Penobscot River Field Survey: 1987
- Scientist, NASA Langley Research Facility, Theoretical Physics Branch: 1982-1984
- Instructor/Resident Advisor, Virginia Governor's School for Advanced High School Students: 1983-1984

Selected Professional Activities

- Editorial Board, Journal of Coastal Research: 1996-present
- Associate Editor, Environmental Geosciences: 1997-present
- Inlet Management Geologist, Sebastian Inlet Tax District, Sebastian Inlet, FL: 2003
- Technical Program Director, Geological Society of America Annual Meeting: 2001, 2005
- Annual Program Committee, Geological Society of America: 2000-2006
- Publications Committee, Division of Environmental Science, American Association of Petroleum Geologists.: 1998-present
- Advising Coastal Scientist, Inter-American Development Bank, Bay Islands Environmental Project, Bay Islands, Honduras: 1996
- Member, Jackson County Emergency Management Team: 1997-present
- Marine Geology Representative, Geological Society of America, Joint Technical Program Committee: 1996-1999

- Member, Scientific and Technical Steering Committee, Vermont State Parks: 1996-1997
- Organizer and Instructor, Organization of American States, Caribbean Short Course on Coastal Processes and Coastal Management: 1993-1996
- Technical Advisor on Coastal Science, National Science Foundation Task Force on Earth Science Education, 1994-1996
- Shipboard Scientist, R/V Cape Hatteras Live Foraminifera Research Cruise, Chief Scientist Bruce Corliss: 1994
- Shipboard Scientist, R/V Knorr Southern Chile Ridge Research Cruise, Chief Scientist Emily Klein: 1993

Honors

- University Scholar Award, Western Carolina University: 2001
- James B. Duke Doctoral Fellowship (1989-1995)
- J. Hoover Mackin Award (Awarded by the GSA's Quaternary Geology and Geomorphology Div.): 1991
- Award for Outstanding Research Proposal, GSA Hydrogeology Division: 1991
- Phi Beta Kappa: 1987

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Recent Research Grants and Awards

- 2005-2007: National Science Foundation. Elwha Education Project: Increasing the Interest in, and Relevancy of the Geosciences for Native Youth Through Participation in Environmental Restoration Projects on Tribal Lands. $90,000
- 2005-2006: National Park Service. Development of a Geologic Monitoring Manual. $118,000
- 2005-2006: Cherokee Preservation Foundation. Planning for a river cane restoration station. $18,500
- 2004-2005: Channel Islands National Park. Wetland restoration at Prisoner's Harbor $12,000
- 2003-2004: Public Entity Risk Institute. Rapid response to Hurricane Isabel. $5,000
- 2002-2004: National Park Service. Paleoecology of Heath Balds in Great Smoky Mountains National Park. $9,500
- 2001-2003: National Park Service, Blue Ridge Parkway. Evolution and Management of Pisgah Bog. $5,000
- 2000-2001: Horowitz Foundation. Addressing the primary public health concern in Roatan, The Bay Islands, Honduras by tracing fecal coliform bacteria from nearshore ocean water to its inland sources. $8,000

- 1999-2002: Public Entity Risk Institute. A new, quantitative method for ranking the factors that control coastal hazards for use in risk mapping and property damage mitigation planning with internet-based distribution. $90,000
- 1999-2002: National Park Service. Wetland Evolution in Great Smoky Mountains National Park. $10,000
- 1998-2000: National Science Foundation, Biological Oceanography, Examining the impact of land-use on offshore sediment transport and reef degradation during a category five hurricane on a mountainous Caribbean Island, Roatan, Honduras**.** $20,000
- 1998-present: WCU Summer Research Grant. Coastal Assessment and coastal zone management of the Bay Islands, Honduras. $5,000
- 1995-1998: Natural Hazards Center, Quick Response Grant. Funding for Hurricane Reconnaissance. Amount is open-ended
- 1997: National Science Foundation, MRI Program. Acquisition of millimeter-scale GPS and geophysical core logging equipment for integrated environmental geology research. $180,000
- 1996-1997: State of New Hampshire, Division of Emergency Management. GIS-Based Coastal Hazard Mapping of the New Hampshire Coast. $12,500
- 1996-1998: National Science Foundation, Division of Undergraduate Education. Enhancement of Undergraduate Field and Laboratory Research Experiences in Lake and Wetland Studies. $29,689
- 1997-1998: South Lake Champlain Trust. The impact of long-term lake-level rise on lakeshore wetlands in Lake Champlain: Understanding the past and predicting the future. $9,859
- 1995: University of Vermont, University Committee on Research and Scholarship. A comparison of post-storm beach recovery on developed and undeveloped barrier island shorelines of the Florida Panhandle Coast following Hurricane Opal, October 4, 1995. $2600
- 1991-1995: National Biological Survey , National Wetlands Research Center. The impact of sea-level rise on the coastal wetlands in Albemarle and Pamlico Sounds, North Carolina: A study of wetland dynamics. $180,000

Professional Organizations

American Association of Petroleum Geologists
American Geophysical Union
Geological Society of America
SEPM (The Sedimentology Society)
Society of Wetland Scientists